The Pan-Pacific Entomologist

Vol. 40 April 1964 No. 2

Host Plants, Population Density, and Parasites of Two Species of Jumping Plant Lice

(Homoptera : Psyllidae)

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This small family of homopterous insects is widely distributed throughout the temperate portions of the world. Several European species have been accidentally introduced into North America where they have flourished and become important economic pests. The pear psylla (*Psylla pyricola* Förster) and the apple sucker (*Psylla mali* Schmidberger) are two examples of such introductions. A native species, the potato or tomato psyllid *Paratrioza cockerelli* (Sulc), is important in that it injects a phytotoxic secretion that causes yellows in some solanaceous crop plants. Many species secrete honeydew and wax, others form galls, and some cause leaf curl on various plants. The bulk of the species is not, however, considered to be economic pests even though both nymphs and adults feed on plant juices. The present paper is concerned with two species, *Trioza collaris* Crawford and *Kuwayama medicaginis* (Crawford), which have not yet been found to be of ecomomic importance although adults of the latter species have been found on alfalfa, *Medicago sativa* L.

Trioza collaris was originally described from California where it has been collected in the following counties: Los Angeles, Inyo, Santa Clara, Santa Cruz, San Francisco, and Contra Costa. Tuthill (1943) gives its distribution as California, Arizona, New Mexico, and Texas. Klyver (1932) collected a number of last instar exuviae on *Baccharis pilularis*, and Tuthill (1943) reported that some of his specimens had been labeled as being collected on *Baccharis viminea* DC. Jensen (1963, *in litt.*) has collected both adults and nymphs on *Baccharis pilularis* at Grizzly Peak, Berkeley, California, 26 March 1948. He further reports that on this date one adult had just emerged and had soft, not fully expanded wings.

Kuwayama medicaginis (Crawford) was originally described from Colorado and subsequently reported from El Centro, Imperial County,

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This project was supported in part by National Science Foundation Grant GB-379.

California. Tuthill (1943) reports specimens from numerous localities in Arizona, New Mexico, and Texas. Caldwell (1941) recorded adults from Iguala, Guerrero, Mexico, 11 September 1939 and from Santa Engracia, Tamaulipas, Mexico, 4 November 1938 (De Long and Caldwell). Crawford (1914) reported that his California specimens were taken on alfalfa, *Medicago sativa* L., and Tuthill (1943) states that it is still in question as to whether this is the true host. Jensen (1963, *in litt.*) reports that he and L. D. Christenson collected adults from alfalfa at Mesilla, New Mexico, 4 December 1939; from Russian thistle, *Salsola kali* L., at La Luz, New Mexico, 12 December 1939; and from creosote bush, *Larrea tridentata* (DC.) Coville, at Sentinel, Arizona, 20 December 1939. Jensen (1960, *in litt.*) also mentions that Dr. Paul Oman found the adults to be abundant on tar bush, *Flourensia cernua* DC., between Marathon and Sanderson, Texas, January 1942. No nymphs or exuviae were in evidence. Until the present time the true host of this species has remained unknown.

TRIOZA COLLARIS CRAWFORD

The following observations on this species were made at a location 2 miles northeast of Portal, Cochise County, Arizona, on the foothills of the Chiracahua Mountains at 4,700 feet. The immediate site was in a dry, earthen tank or catch basin that had about 40 shrubs of *Baccharis glutinosa* Pers. along the margins, primarily on the north and east sides, inside the tank. At the time the studies were made, August 1960 to January 1961, all the plants were healthy and either in full bloom or had the old blossoms still on the plants.

The adults of *Trioza collaris* were first noticed on the flowers in August 1960 but it was not until 12 September that they figured in another project and became the subjects of more detailed observation. On this date a pair of Wilson's (Pileolated) Warblers, *Wilsonia pusilla pileolata* (Pallas), moved into the area and fed on the adults, primarily on three shrubs, for a period of several days. On 22 October samples of the flowers were cultured and 2 days later the adult psyllids began to emerge and continued to do so until the middle of December. By 10 January 1961 very few adults were in evidence in the field.

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EXPLANATION OF FIGURES

Fig. 1. (upper photograph) Adult *Trioza collaris* Crawford on flower head of *Baccharis glutinosa* Pers. Photo by Marjorie Statham. Fig. 2 (lower photograph) Nymphs of *Kuwayama medicaginis* (Crawford) *in situ* in opened flower head of *Flourensia cernua* DC. Photo by Marjorie Statham.

Nymphal parasites began emerging from these cultures on 29 October, or 7 days after being cultured, and continued to do so until the middle of December. Dr. B. D. Burks has described these as *Tetrastichus psyllaephagus* Burks belonging to the family Eulophidae. Jensen (1957) records five identified and three undetermined species of *Tetrastichus* as known parasites of eight determined and two undetermined species of the psyllid genus *Trioza,* six of which are from North America: *Tetrastichus dyrus* Burks on *Trioza* sp. in Montana, *Tetrastichus gelastus* Burks on *Trioza* sp. in Florida, *Tetrastichus triozae* Burks on *Trioza albifrons* Crawford and *T. beameri* Tuthill in California, *Tetrastichus* sp. on *Trioza bakeri* Crawford in California, and *Tetrastichus* sp. on *Trioza maura* Förster in California. To this list we can now add *Tetrastichus psyllaephagus* on *Trioza collaris* in Arizona. The *Tetrastichus psyllaephagus* parasite overwinters in both the pupal and adult stages inside the last instar nymphal skins of *Trioza collaris* in the dried-up flower heads of *Baccharis glutinosa.* Several dried flower heads containing defunct nymphs of *Trioza collaris* were collected on 8 February 1963. The *Tetrastichus* adults began to emerge immediately and continued to do so until 26 February under laboratory conditions. Both pupae and adults of the wasp were in the *Trioza collaris* nymphal skins when they were first collected, and the pupae were already heavily pigmented.

In the young nymphs of *T. collaris* it was impossible to detect which individuals were parasitized. However, in the last instar the nymphs were immobilized and usually fastened to the substrate, and the developing parasite could be seen inside. Emergence from the nymphal skin was accomplished through an irregular hole cut by the adult wasp through the dorsum, occasionally the venter, of the abdomen near the apex. The amount of time required for the adult wasp to emerge after detection varied from 11–14 days under laboratory conditions.

The eggs of *Trioza collaris* are laid beneath the closely adhering phyllaris (bracts of the involucre, in Compositae) and are probably placed in this position by the females inserting the short, sharp ovipositor through a phyllary. They are oblong, light green in color, and are arranged radially with the inner end stuck to the substrate next to the ends of other eggs in the cluster. Of several hundred egg clusters examined

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EXPLANATION OF FIGURES

Fig. 3. (upper photograph) Inflorescence of *Baccharis glutinosa* Pers. containing an estimated 5,446 nymphs and eggs of *Trioza collaris* Crawford. Photo by Marjorie Statham. Fig. 4. (lower photograph) Flower head of *Flourensia cernua* DC. showing wax secreted by nymphs of *Kuwayama medicaginis* (Crawford). Photo by Marjorie Statham.

all had six eggs except one, which had only two. The number of egg clusters per flower head varied from 0–6 and in all cases nymphs in varying stages of development were already present. In one with five clusters (30 eggs) there were already 80 nymphs present. In another with six clusters (36 eggs), 21 nymphs were already present (Table 1).

The nymphs are located inside the flower heads, head downward between the florets with their long threadlike mouthparts inserted in the receptacle of the flower head. The larger nymphs were near the surface of the flower head where the tips of their abdomens could be seen and the small ones were hidden beneath. Maturation takes place in the flower head, and with the emergence of the adult the cast nymphal skin ends up on top where it is easily dislodged. They evidently do not kill the flowers even when in large concentrations, but they may be responsible for discoloration and general weakening. Unlike some of the other Psyllidae the nymphs of this species have no waxy or cottony secretion. Copulation has been observed to take place on the flowers, leaves, and stems of the plants. They evidently overwinter as adults in protected portions of the plant, including the old flower heads, and numerous specimens were collected in these situations between 8–10 February 1963. No eggs were found in the old, dried flowers or on the leaves.

On 29 and 30 October 1960, ten flower heads were selected at random from ten different inflorescences on ten different bushes and their contents (eggs and nymphs) counted. The results of these counts (Table 1) are interesting from a population standpoint and probably represent a

Table 1.—Population density of eggs and nymphs of *Trioza collaris* Crawford in ten flower heads from ten different inflorescences from ten different bushes of *Baccharis glutinosa* Pers., 29 and 30 October 1960.

Number	Flower Head Diameter in mm	Number of Nymphs	Number of Egg Clusters	Number of Eggs	Total Nymphs and Eggs per Flower Head	Percentage of Eggs	Percentage of Nymphs
1	4 × 6	24	2	12	36	33.3	66.7
2	4 × 4	34	3	18	52	34.6	65.4
3	3 × 4	7	0	0	7	0	100.0
4	5 × 5	80	5	30	110	27.3	72.7
5	4 × 6	41	2	12	53	22.6	77.4
6	6 × 7	21	6	36	57	63.2	36.8
7	6 × 6	20	4	20	40	50.0	50.0
8	6 × 7	62	3	18	80	22.5	77.5
9	7 × 7	90	3	18	108	16.7	83.3
10	7 × 7	88	1	6	94	6.4	93.6

minimum figure rather than maximum since no adult counts were made. The individual flower heads were found to contain an average of 63.7 nymphs and eggs. There was an average of 85.5 flower heads per inflorescence which means a population of 5,446 nymphs and eggs per inflorescence. The bushes were found to have an average of 100 inflorescences each or a population of 544,600 psyllids per bush. Since there were 40 *Baccharis glutinosa* shrubs present, it indicates a population of about 21,784,000 nymphs and eggs of *Trioza collaris* on these 40 plants. This is exclusive of the many thousands of adults that were also present at this time. The sample of ten also shows that of this number about 73% were nymphs and 27% eggs, thus indicating an earlier period of maximum oviposition.

Kuwayama medicaginis (Crawford)

The following observations on *Kuwayama medicaginis* were made on the same plot as described under *Trioza collaris* and also in an area 1 to 2 miles east of Portal, Arizona. In these areas the breeding host is *Flourensia cernua* DC., as it probably is in Texas, and the nymphs are found in the sticky flower heads. Their presence was first noticed on 4 December 1960 when the white, waxy, nymphal secretion was seen in the tops of the flower heads. The nymphs were arranged in a manner similar to those of *Trioza collaris*, with the older ones near the surface and the younger underneath. No eggs could be found and, although not counted, the population density was much lower than in *Trioza collaris*, possibly because of spatial competition. A high percentage of the flower heads was infested by the larvae of a fly (*Trupanea* sp.) and the larvae of a weevil, *Smicronyx profusus* Casey, which occupied most of the center of many of the flowers.

On 4 December 1960 many flower heads were cultured and the adults of *Kuwayama medicaginis* began emerging from them on 6 December. These continued to emerge until early February 1961. On 10 January 1961 nymphal parasites began emerging and continued to do so until early February. Dr. B. D. Burks determined these as *Psyllaephagus trioziphagous* (Howard), an encyrtid parasite previously known only from *Trioza diospyri* (Ashmead). This parasite overwinters in the pupal and adult stages inside the last instar nymphal skins of *Kuwayama medicaginis* in the dead, persistent flower heads of *Flourensia cernua*. The adult wasps began emerging immediately from dried flowers collected on 8 February 1963 and continued to do so until 29 March 1963 under laboratory conditions. Most of them emerged within 10 days of being collected. Emergence from the nymphal skins is accomplished through a small, irregular hole cut by the adult parasite through the dorsum, oc-

casionally through the venter, of the abdomen near the apex. An anthocorid (Anthocorinae) predator was also found in all its nymphal stages, as well as eggs and adults, feeding on the nymphs of *Kuwayama medicaginis*. Dr. R. C. Froeschner was unable to determine the genus or species since the subfamily is badly in need of revision. We were unable to locate the eggs of *Kuwayama medicaginis* and may have been too late in the season for them.

Acknowledgments

The writer would like to express his sincere appreciation to Dr. D. D. Jensen, Department of Entomology and Parasitology, University of California, Berkeley, for his assistance, cooperation, and encouragement which made this paper possible. Grateful acknowledgment of assistance is also extended to Dean E. Gorton Linsley, Dr. Ray F. Smith, and Dr. Paul D. Hurd of the University of California, Berkeley; Dr. Karl V. Krombein, Dr. B. D. Burks, Dr. W. H. Anderson, and Dr. R. C. Froeschner of the United States Department of Agriculture, Entomological Research Division, Beltsville, Maryland. The writer is indebted to Miss Marjorie Statham, Department of Entomology, American Museum of Natural History, New York, and to Mr. Martin A. Mortenson of the Department of Entomology and Parasitology, University of California, Berkeley, for the excellent photographs.

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